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Such conditions, however, when the characteristic ciliate perianths are wanting, can usually be distinguished from any state of *P. rivularis* by the more oblong, more distinctly marginate, dorsal leaf-lobes, and by the longer and narrower ventral lobes and underleaves, which are more pronouncedly caudate at the base.

The above revision is based, outside of our own collections in California, chiefly upon the rich representation of this genus in the herbarium of Professor Underwood, and upon the specimens in the herbarium of Columbia University. We further gratefully acknowledge our indebtedness to the Philadelphia Academy of Sciences, for the loan of the Schweinitz collection; to Dr. A. W. Evans for the privilege of examining specimens in his own herbarium and that of Yale University, and to W. H. Pearson, Esq., of Knutsford, Cheshire, England, for the loan of the type of *Porella Bolanderi*.

COLUMBIA UNIVERSITY, DEPARTMENT OF BOTANY,

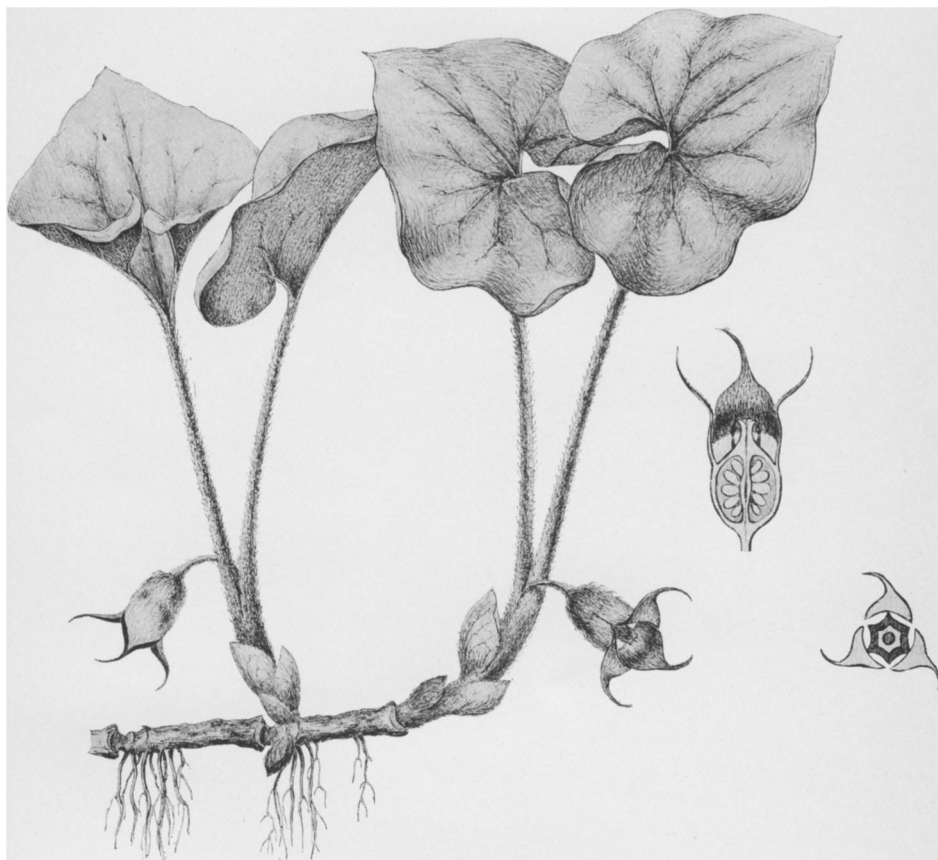
November 13, 1897.

A new Species of Wild Ginger hitherto confounded with *Asarum Canadense* L.

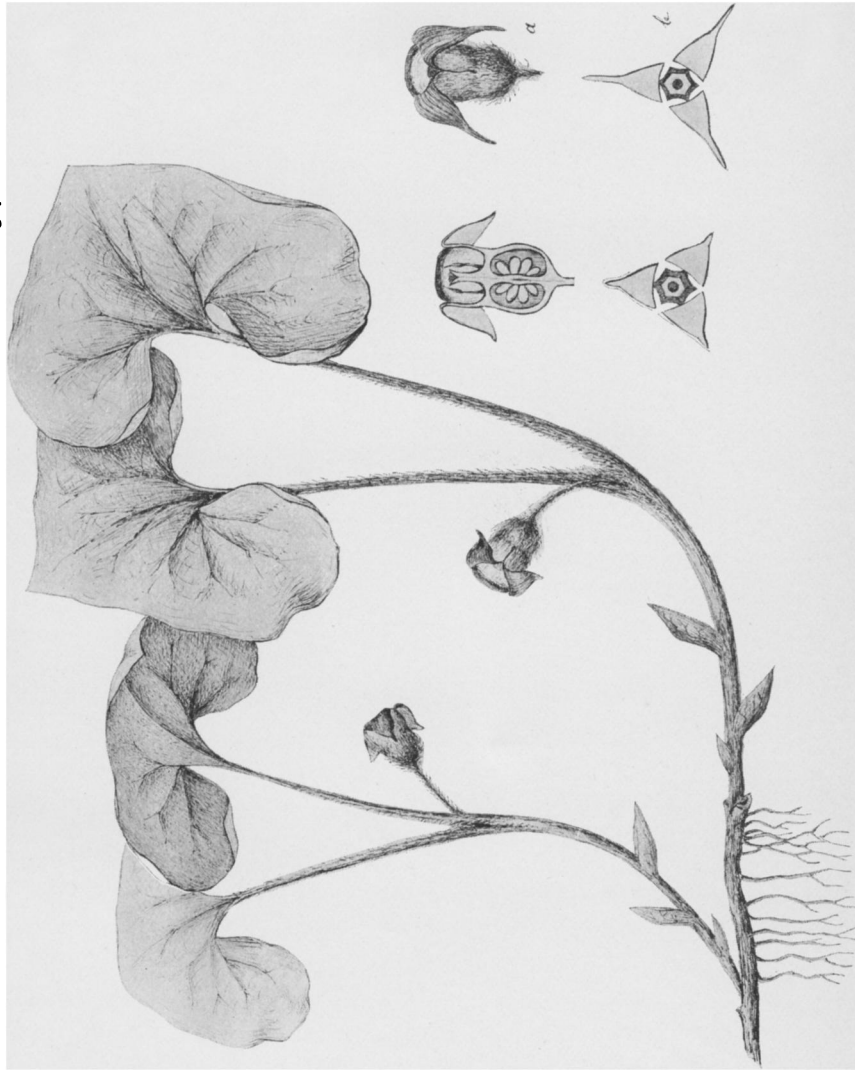
BY EUGENE P. BICKNELL.

(PLATES 316, 317.)

It has certainly much significance in its bearing on the study of our common flora that a plant so noteworthy as the familiar wild ginger, and supposedly so well understood, should now reveal itself as embracing two perfectly distinct species. Both plants are common and widely distributed, but they are so much alike in general appearance that it is scarcely a matter of surprise that they have held their secret so long. Agreeing in main features throughout, they share the same general form of rootstock, leaf and flower, are similar in habit of growth, and bloom at the same time. The differences between them are, in fact, no greater than might fairly measure the variation of a single species, and that they are of higher import has been learned only by careful field study continued through several seasons.



ASARUM CANADENSE L.



ASARUM REFLEXUM BICKNELL.

While the determination of dried specimens is not always easy, living plants may always be distinguished instantly by a glance at the flowers, and further comparative study cannot fail to lead to their recognition as beautifully similar yet beautifully distinct species.

The most obvious differences between these plants reside in the flowers. In one the calyx-lobes are spreading and revolute passing gradually into a slender upcurved acumination, and the interior of the tube is purple nearly down to the base ; in the other species the calyx-tube is white within and the flat and reflexed lobes are abruptly acuminate at the apex into a straight obtuse point.

Fortunately there need be no uncertainty as to which one of these plants should bear the name *Asarum Canadense* L. Although the description in Species Plantarum is diagnostic of neither species the citations there given establish conclusively that the Linnaean plant was the one with gradually acuminate calyx-lobes.

The following references enter into the foundation of the Linnean species :

“Gron. Virg. 52.

Moris. hist. 3. p. 511. s. 13. t. 7. f. 4.

Corn. Can. 24, t. 25.”

The specimen of Gronovius is perhaps no longer in existence, nor is it of any great consequence in view of the sufficiency of the remaining citations. I am indebted to Mr. Edmund G. Baker for the information that this particular type is not to be found among the Gronovian specimens in the British Museum. I have also to thank Mr. Baker for a tracing of the illustration in the rare work of Morison. This figure proves to be merely a reduced copy of the plate of “*Asaron Canadense*” in Cornuti’s “*Canadensium Plantarum*,” published in 1635, which is a crude but quite unmistakable illustration of the plant with gradually acuminate calyx-lobes, establishing perfectly the significance of the Linnaean name.

The synonymy of this plant is as follows :

ASARUM CANADENSE L. Sp. Pl. 1: 442. 1753.

A. Carolinianum Walter, Fl. Car. 143. 1788.

A. latifolium Salis. Prodr. 344. 1796.

A. Canadense β *obtusum* Muhl. Cat. 1813.

A. acuminatum Muhl. Cat. ed. 2. *Nomen nudum*. 1818.

A. parviflorum Raf. New Fl. 2 : 20. 1836.

A. furcatum Raf. l. c.

A. medium Raf. l. c.

"*A. villosum* Muhl. Cat." vide Duchartre in DC. Prodr. 15 : 424. 1864.

It is quite possible that one or more of these names had at least partial reference to the neglected species here discussed, but there is nothing in the definition of any one of them to justify its present revival.

The three names of Rafinesque are together passed into the synonymy of *A. Canadense* L. by this remark of Rafinesque himself in connection with his descriptions : "The *A. Canadense* differs from all these by smooth reniform leaves, calyx reflected, etc." These words evidently refer to our new species, and show that Rafinesque really knew both of our plants but made the mistake of renaming true *Canadense*, assuming that to be the one which was undescribed.

It appears probable that Muhlenberg earlier fell into the same error. His *nomen nudum*, *Asarum acuminatum*, may well have referred to true *Canadense*, allowing the inference that his further catalogue names, *A. Canadense* and its variety *obtusum*, really stood for the undescribed plant. This, however, is only conjecture, and as the leaves of true *Canadense* are either acute or obtuse no warrant it found for now taking up Muhlenberg's varietal name. There is little doubt that Salisbury's name, *Asarum latifolium*, is a synonym. The description of this plant as quoted by Willdenow (I have not seen the original publication) correlates it sufficiently with the Linnean species.

Walter's plant was doubtless based on a malformed example of one or the other of our species, both of which sometimes occur with "*folius* * * *emarginatus*," apparently the result of accident to the growing bud ; nothing in Walter's description is distinctive of either plant. It would thus appear that there is no sufficient evidence that the new plant has ever had a name. It may now there-

fore be called *Asarum reflexum* in allusion to its characteristically reflected calyx-lobes.

The two plants agree in the following characters :

Rootstock horizontal, branching, jointed, each internode marking one season's growth, and throwing out long fibrous roots ; leaves two, rising on long, erect, pubescent petioles from the ends of the new shoots, appearing opposite by suppression of the axis ; leaf-blades reniform, the innermost in the bud commonly more acute than the outer one and often with a shallow indentation on either side giving it a slightly three-lobed outline ; new shoots provided with three large, membranous, alternate scale-like bracts subtending minute axillary buds which may or may not develop into branches ; flower solitary, peduncled in the fork of the petioles ; calyx coherent below with the six-celled, many-seeded ovary, campanulate, three-parted with spreading limb, pubescent, the tips of the valvate sepals inflexed in the bud ; stamens twelve, alternating in a longer and shorter series subequal with the united styles and inserted at the base of the column, at first recurved against the surface of the ovary, each series finally rising in turn against the column, the longer series first ; filaments longer than the adnate, extrorse anthers, the connective terminating in a subulate projection ; styles coherent in a column 6-lobed at the apex, separating and spreading at maturity, the cells of the ovary opening loculicidally ; capsule bursting irregularly and dissipating in loose mealy tissue ; seeds ovoid, prominently carunculate.

ASARUM CANADENSE L.

Rootstock short, stout, 2.5–15 cm. long, 6–10 mm. thick, short-jointed, constricted at the nodes, its branches short, spreading or reflexed, sub-opposite, often approximate, usually developed only from joints of the preceding season on rhizomes of several years' growth ; joints or internodes puberulent, 1.5–4 cm. long, the lower end of each joint contracted, and narrowly scarred from the insertions of the fallen bracts ; roots numerous, mostly clustered at the lower ends of the internodes, often densely matted together ; bracts broadly ovate, more or less puberulent, obtuse, approximate or overlapping, finally loosely spreading and deciduous ; leaves commonly reniform-cordate, little, if at all, broader than long, with a deep, often partly closed sinus, acute or obtuse at the apex, rugose-veiny, the hirsutulous-puberulent upper surface with a satiny lustre, the lower surface somewhat shining beneath the close pubescence of minute white hairs ; petioles 3–6 mm. thick, at first canescent throughout or densely white-pubescent with short, spreading or slightly reflexed hairs, becoming

more loosely pubescent, or puberulent, often with cinereous or somewhat rusty hairs; leaves at first 4–7 cm. broad on petioles, 2.5–5 cm. long, later becoming much larger, and reaching an extreme size of 21 cm. wide by 19 cm. long on petioles 32 cm. in length; flowers at anthesis usually reclining on the ground on short, spreading or declined peduncles, at maturity often erect or raised on ascending or erect peduncles 13–40 mm. long; freshly opened flower about 1.3 cm. long, the tube of the calyx about twice the length of the ovary, when fully grown, often 2.5 cm. long and 12–15 mm. wide, the ovary and tube of about equal length; upper half of the erect calyx-lobes spreading or ascending, somewhat crescentic in outline with revolute margins which pass into an upcurved tubular acumination 4–8 mm. long; spread of the flower across the acuminate lobes 2–3.8 cm., the opening of the tube circular; rudimentary petals almost always present as filiform bodies 2–4 mm. long, rising from the surface of the ovary opposite the sinuses of the calyx; peduncles and calyx villous-pubescent, or in age nearly canescent, the spreading purple segments densely erect-puberulent with thickish purple hairs, or sometimes greenish and nearly glabrous, probably through abrasion; inflexed tips of the calyx-lobes in the bud coherent and extending down to the tip of the column; exterior of the calyx hexagonal, the six faces plane, dull-whitish to greenish-purple, the interior of the tube deep purple more than half-way down to the white base which surrounds a hexagonal purple band enclosing the stamens; surface of ovary at maturity somewhat pyramidal, rising into the short, thick terete column which is 2–4 mm. high and rather deeply six-lobed at the summit; stigmas prominent, at anthesis pale pink and densely spiculate; stamens dull pinkish-purple, anthers dull pink; prolonged tips of the filaments slender-subulate, from one to three times the length of the anther in the longer series of stamens. (Plate 316.)

Specimens examined indicate a range from Quebec and Ontario to western Massachusetts, southeastern New York and Pennsylvania and southward in the Alleghanies to Virginia. Mr. Pollard tells me that the species is frequent about Washington.

The plant grows in rich hilly woods often in rocky situations. It begins to flower at New York from the third week in April to the first week in May; in some seasons flowers are still to be found at the end of June.

After the flower has fallen the bud for the next season's growth appears at one side of the cicatrix left by the peduncle, or

sometimes an opposite bud also forms, but fails to develop. In late summer the primary bud is well developed and encloses the next season's flower and leaves perfectly formed.

Two instances of dimerous flowers have been observed, and it is recorded by Decainse (D.C. Prod. 15: 424), that tetramerous flowers are not rare. Occasionally the plant develops undersized leaves which are oblong with rounded or slightly cordate base, or even decurrent into the petiole.

ASARUM REFLEXUM n. sp.

Rootstock slender and elongated, 1.-4.5 dm. long, about 4 mm. thick, or shorter and stouter in one form of the plant, its branches usually slender and remotely alternate, often elongated and again branched; internodes 4-10 cm. long, little if at all contracted at the joints, glabrous, the bract scars prominent, the uppermost distant; roots fewer and more slender than in *Canadense*, more scattered, or borne mainly at the forward ends of the internodes; bracts narrower and more acute than in *Canadense*, less pubescent, more or less separated or distant, early spreading and deciduous; leaves broader than long, varying from reniform and lunate-reniform with a shallow open sinus to suborbicular with a deep sinus, obtusely pointed, broadly acute or rounded at the apex, darker green, thinner and less rugose than in *Canadense*, commonly nearly glabrous above and with a satiny lustre, somewhat shining on the lower surface through the thin or sometimes close pubescence of minute hairs; a common size of the leaves is 10 cm. wide, by 8 cm. or less long on petioles 1.5 dm. long, an extreme size 1.7 dm. wide on petioles 2. dm. long; at vernation the petioles are relatively longer than in *Canadense*; petioles slender, 3-4 mm. thick, loosely or thinly tortuose-pubescent with slightly longer and softer hairs than in *Canadense*, somewhat shining on the outer surface and mostly glabrous towards the base except along the villous-pubescent inner margins, often nearly glabrous throughout in age; flowers smaller than those of *Canadense*, 8-20 mm. long, 7-14 mm. wide, spreading 16-26 mm. across the extended lobes, the tube 4-8 mm. high, at anthesis on slender ascending or erect peduncles, at maturity mostly spreading or reclined on peduncles 3.8-5 cm. long; the ovary from the first about the length of the calyx-tube; limb early reflexed, in age sometimes ascending, the lobes 8-10 mm. long, about the length of the tube, flattish and rather brittle, triangular in outline, ending abruptly in a straight obtuse point 2-4 mm. long; opening of the flower commonly more or less triangular; rudimentary petals

usually wanting; peduncle and calyx densely cottony-villose, much less so in age, the outer surface of the sepals loosely pilose-pubescent, the reflected brownish-purple segments somewhat shining and minutely puberulent with dull purple hairs and faintly parallel-veined; inflexed tips of the sepals in the mature bud extending only half-way to tip of column; interior of tube white or greenish-white below the rim, the disk surrounded by a purple band as in *Canadense*; exterior of flower white to greenish-purple, the hexagonal base with prominent rounded angles and intervening depressions; surface of ovary plane or nearly so; column slender, columnar, longer than in *Canadense*, 4–7 mm. long, strongly grooved to receive the longer series of stamens, the stigmas greenish and purple, rather smaller than in *Canadense* and often merely granulose; stamens deeper purple than in *Canadense* with shorter anthers, the filaments slightly longer and closer to the column, their tips shorter and less attenuate, often less than half the length of the anther. (Plate 317.)

Rich low woods along streams or river valleys, often forming extensive beds; more rarely in upland woods; flowering at the same time as *A. Canadense*. Southeastern New York, and doubtless Connecticut, to Iowa, south to the mountains of North Carolina, Missouri and Kansas.

Aside from the notable differences of the flowers which has already been emphasized, *Asarum reflexum* differs generally from *A. Canadense* in more slender habit, sparser pubescence of rather longer hairs, and more broadly reniform leaves. The plant is also much less aromatic.

The typical form of the plant which occurs in rich woodland along the banks of streams and rivers is particularly characterized by slender elongated rootstocks loosely interlaced on and near the surface of the ground, long internodes, and broad leaf-blades with divergent sides and wide openly graduated sinus. The occasional form of drier upland woods is rather stouter and more pubescent with shorter internodes and rootstocks, the leaf-blades commonly suborbicular and more or less rounded at the apex, the sides parallel or approaching rather than divergent and rounding into or even overlapping at the sinus, which is very wide at the insertion of the petiole; the opening of the flower is nearly circular instead of more or less triangular as in the type.

This plant has been especially studied in Van Cortlandt Park, New York City, where the typical form is found in abundance in the woodland along Tibbit's Brook and the upland form also occurs. Through the kindness of Prof. Trelease I have been enabled also to examine fresh material from the vicinity of St. Louis.

A single plant bearing a 4-merous flower was collected in Van Cortlandt Park.

Type material from Van Cortlandt Park will be deposited in the Herbaria of Columbia University and the New York Botanical Garden, the Gray Herbarium and the Herbaria of the Missouri Botanical Garden and the U. S. Department of Agriculture.

The foregoing description of *Asarum reflexum* has been drawn to cover only the typical plant and its causal variations. It would appear that a geographical variety must also be recognized. Living specimens were sent to me in May, 1897, collected on the bank of the Desplaines river at Maywood, Illinois, near Chicago, which, though essentially like the type, show characters apparently never developed by the more eastern plant. As in the case of *A. reflexum* and *A. Canadense* here again the most evident differences are found in the flower, which shows especially a notable elongation of the strongly reflexed calyx-segments as denoted in the accompanying illustration (Plate II., a, b).

The variety may be characterized as follows :

ASARUM REFLEXUM AMBIGUUM n. var.

Slender, the leaf-blades short and very broad with a deep wide sinus and mostly abruptly pointed at the apex, the lower surface rather densely, even softly, pubescent; flowers often longer and narrower than in *reflexum*; exterior of calyx nearly white, very woolly tomentose, the tube 8–10 mm. long, the reflexed lobes longer and narrower than in the type with much longer points, 8–9 mm. wide at the base, 12–17 mm. long, the straight slender points 4–8 mm. long, sometimes extending back to the base of the calyx and closely appressed against it; surface of reflexed lobes light brownish-red, distinctly parallel-veined, glabrate; column short, 3–4 mm. high; hexagonal band on surface of ovary narrower than in the type and of a bright purplish-red color.

In one specimen the calyx-lobes are almost pointless, but are longer than normally and evenly graduated to the apex.

The type will be deposited in the Herbarium of the New York Botanical Garden.

A comparative histological study of *Asarum reflexum* and *Asarum Canadense* has been undertaken by Dr. Albert Schneider, now of Northwestern University, the results of which will shortly be published. Dr. Schneider tells me that his preliminary examination shows that the histological elements are structurally almost identical in the two plants, but that their arrangement and relative abundance are strikingly different. In *A. reflexum* the annular and spiral vessels are much more numerous than in *Canadense*, in which tracheids predominate. The usual reaction tests for *Canadense* meet with a weaker response from *reflexum* very much as with *A. Europaeum*. Dr. Schneider is of the opinion that the new plant should probably be excluded from the Pharmacopæia owing to the apparently deficient medical principle. A careful chemical analysis is necessary to decide this.

The drawings are reduced in engraving to about two-thirds natural size.

* The proofs of this article came to hand a few days after the receipt of a privately printed paper by Mr. W. W. Ashe, entitled "The Genus *Asarum* in Eastern America," in which is described *Asarum Canadense acuminatum* nov. var. The points of distinction indicated for this new variety are "Calyx-lobes gradually acuminate, longer than the tube," *Canadense* itself being credited with calyx-lobes "as long as or somewhat longer than the tube, abruptly acuminate."

As already shown in the present paper, the one of our two common eastern plants having the longer more gradually acuminate calyx-segments is the authentic *Asarum Canadense* of Linnaeus, and the very plant, in all probability, to which Muhlenberg afterwards applied the name *acuminatum*, now again used by Mr. Ashe.

There occurs in Minnesota a form of *Asarum* having very long, slenderly acuminate calyx-lobes and apparently occupying a position between *A. Canadense* and *A. caudatum*. Having seen but a single specimen of this plant allusion to it was deferred until further material should be forthcoming. Minnesota is one of the localities named by Mr. Ashe for his new variety, which may very possibly represent a plant not found at all farther east. The matter cannot be followed to a conclusion at the present time, when this paper goes at once to press.